

IN THE DISTRICT COURT OF THE UNITED STATES
FOR THE DISTRICT OF SOUTH CAROLINA
GREENVILLE DIVISION

Ethox Chemical, LLC and James
Tanner,

Plaintiffs,

vs.

The Coca-Cola Company,

Defendant.

Civil Action No. 6:12-1682-KFM

ORDER

This matter is before the court following a bench trial on September 14-17, 2015. The case was referred to this court for disposition on October 7, 2014, upon consent of the parties pursuant to Title 28, United States Code, Section 636(c), and Local Civil Rule 73.01(B) (D.S.C.), by order of the Honorable Bruce Howe Hendricks, United States District Judge.

This action for correction of inventorship¹ of United States Patent No. 8,110,265 ("the '265 Patent") pursuant to 35 U.S.C. § 256 is before this court on federal question jurisdiction. The plaintiffs, Ethox Chemical, LLC ("Ethox") and James Tanner ("Dr. Tanner"), claim that Dr. Tanner made an inventive contribution to Claim 11 of the '265 Patent, which is owned by the defendant, The Coca-Cola Company, and therefore the patent should be corrected to name him as a co-inventor. The defendant has alleged counterclaims for imposition of a constructive trust and a declaration that Dr. Tanner is not an inventor of the '265 Patent (see doc. 46).²

¹The plaintiffs alleged additional causes of action that were dismissed prior to trial (see docs. 43, 202).

²The defendant dismissed its counterclaim for breach of contract prior to trial (see doc. 227).

EVIDENCE PRESENTED

At trial, the plaintiffs offered testimony from Dr. Robert M. Kriegel, a Senior Scientist in the defendant's Global Packaging Group and a named co-inventor on the '265 Patent; Dr. Charles Hinton, President of Ethox; Dr. Tanner, a Research Chemist and Synthesis Laboratory Manager at Ethox and co-plaintiff in the present lawsuit; Dr. Charles F. Palmer, Vice President of Technical at Ethox; Dr. Geoffrey Coates, the plaintiffs' technical expert; and Stephen G. Kunin, the plaintiffs' expert on patent practice and procedures. The plaintiffs also submitted video deposition testimony from Dr. Robert J. Schiavone, co-owner and Vice President of PolyTech Resources ("PolyTech") and a named co-inventor on the '265 Patent; Dr. T. Edwin Freeman, a Senior Scientist in the defendant's Global Packaging Group and a named co-inventor on the '265 Patent; and Dr. Xiaoyan Huang, a scientist who works for the defendant specializing in polymer science and a named co-inventor on the '265 Patent.

The defendant offered testimony from Dr. Kriegel; Dr. Freeman; Dr. Timothy Long, the defendant's technical expert; and John Doll, the defendant's expert on patent practice and procedures. The defendant also submitted video deposition testimony from Dr. Michael E. O'Brien, a Research Associate at Stepan Company ("Stepan").

The following exhibits were admitted during trial: joint exhibits ("J") 1-4 and 7; the plaintiffs' exhibits ("PTX") 6, 8, 11-12, 16-17, 20-25, 29-30, 34, 36, 39, 41, 52, 65-66, 77, 128.06-128.07, 130.01, 139, 158-159, 164-166, 185, 191-194, 199-200, and 201-203 (transcripts of deposition designations); and the defendant's exhibits ("DTX") 8, 17, 24, 33, 51, 56, 58, 65C, 67, 71-73, 75, 152-154, 169, 181, 214, 246, 263, 329, 337-340, 342, 344, and 358 (transcript of deposition designations) (see docs. 266, 267, 268).

LEGAL STANDARD

This is an action for correction of inventorship under 35 U.S.C. § 256, which provides in pertinent part:

The error of omitting inventors or naming persons who are not inventors shall not invalidate the patent in which such error occurred if it can be corrected as provided in this section. The court before which such matter is called in question may order correction of the patent on notice and hearing of all parties concerned and the Director shall issue a certificate accordingly.

35 U.S.C. § 256 (effective Nov. 2, 2002, to Sept. 15, 2012).³ "Issued patents are presumed to correctly name the inventors; therefore, '[t]he burden of showing misjoinder or nonjoinder of inventors is a heavy one and must be proved by clear and convincing evidence.'" *Bard Peripheral Vascular, Inc. v. W.L. Gore & Associates, Inc.*, 776 F.3d 837, 845 (Fed. Cir. 2015) (quoting *Hess v. Advanced Cardiovascular Sys., Inc.*, 106 F.3d 976, 980 (Fed. Cir. 1997)). This "issue of joint inventorship is governed by 35 U.S.C. § 116," *Fina Oil & Chem. Co. v. Ewen*, 123 F.3d 1466, 1473 (Fed. Cir. 1997), which, by its terms, allows for joint inventorship even when the co-inventors "did not make the same type or amounts of contribution," or "did not make a contribution to the subject matter of every claim of the patent." 35 U.S.C. § 116.

Following trial, the parties submitted proposed findings of fact and conclusions of law, which have been considered by the undersigned and incorporated herein to the extent they are consistent with this court's determination of the facts and the law. Having heard and observed the witnesses who testified at trial, having considered the exhibits introduced by the parties, and having reviewed the applicable law, the court now declares the following findings of fact and conclusions of law pursuant to Federal Rule of Civil

³Because this proceeding was commenced before September 16, 2012, this case falls under the prior version of § 256, which was recently amended by the America Invents Act.

Procedure 52(a).⁴ Should a finding of fact constitute a conclusion of law, or vice versa, the court adopts it as such and directs that it be treated accordingly.

FINDINGS OF FACT

Parties

1. Plaintiff Ethox is a chemical company located in Greenville, South Carolina that specializes in esters and surfactants, which are used in a multitude of industrial and personal applications, and handles ethylene oxide (Tr. 119-21). Plaintiff Dr. Tanner is a Research Chemist and Synthesis Laboratory Manager at Ethox (Tr. 164).
2. The defendant's Global Packaging Group is an industry leader in researching and developing innovative beverage packaging (Tr. 727).

PET Bottles

3. The defendant pioneered the large-scale use of polyethylene terephthalate ("PET") bottles as beverage containers over three decades ago (Tr. 642-43). PET bottles were originally introduced to the market as a replacement for glass bottles (Tr. 644). PET bottles provide a premium look similar to glass, with the added advantage that they are not brittle and therefore will not break (Tr. 728-29).
4. One of the disadvantages of PET is that it is porous to gas (Tr. 29-30, 643-44, 729). As such, carbonation in beverages will gradually escape from the bottle (Tr. 29-30, 643-

⁴At the conclusion of the plaintiffs' case, defense counsel made an oral motion for judgment as a matter of law on the plaintiff's correction of inventorship claim and also filed a written motion (doc. 261). The court took the motion under advisement and proceeded with the trial. The defendant renewed the motion at the close of its case. Following the trial, the plaintiffs submitted a brief in opposition to the motion (doc. 273). "A motion for judgment as a matter of law is made under Federal Rule of Civil Procedure 50, which applies in jury trials. The proper motion in a non-jury trial is a Rule 52(c) motion for judgment on partial findings, and the court will construe the defendant's motion as such." *Cadence Bank, N.A. v. Horry Properties, LLC*, C.A. No. 4:10-CV-2717-RBH, 2012 WL 1110089, at *1 n.1 (D.S.C. Apr. 2, 2012). "Under this Rule, a court assesses the evidence presented and may render judgment if the evidence is insufficient to support a claim or defense." *In re Mondanlo*, 413 B.R. 262, 265-66 (Bankr. D. Md. 2009) (citing *Carter v. Ball*, 33 F.3d 450, 457-58 (4th Cir. 1994)). The defendant's motion (doc. 261) is denied for the reasons set forth herein.

44). The defendant has employed Ph.D. polymer chemists to work on improving the mechanical properties of PET bottles (Tr. 25-28, 31-34, 644-45, 729-32; DTX 329).

5. The defendant's scientists have conducted research and development of technologies to slow down the escape of gas through PET bottles (Tr. 55-57, 643-45, 656-79, 729; DTX152, DTX169, DTX329, DTX337, DTX338, DTX342). One of these methods involves using gas barrier additives that make it more difficult for gas to escape the bottle (Tr. 28-29, 53-54, 730-32, 749-50; PTX130.01, DTX008).

6. The additional pressure to the PET caused by slowing egress of the gas, however, creates a "ballooning" effect in the bottles, known as "creep" (Tr. 48-49, 644, 677-78). The defendant's scientists recognized that a creep control agent also needed to be added to the PET resin to prevent bottle deformation, but in a controlled amount so as to not negatively impact the clarity of the PET (e.g., haze or discoloration) (Tr. 677-78, 752-53). The defendant's scientists developed a particular type of "drop-in" technology in which certain gas barrier additives and creep control agents are added to PET resin used to make bottles (Tr. 675-79).

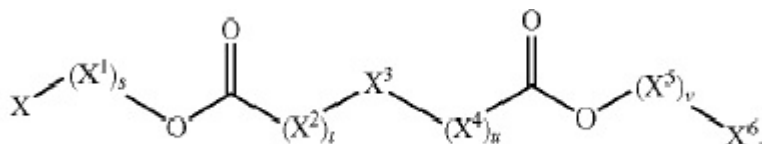
The '034 Provisional Application

7. Among the gas barrier additives the defendant's scientists considered was a molecule called BPO-1 (Tr. 83, 669-70, 733). Between January 2006 and March 2007, Dr. Kriegel came up with a synthetic pathway to make BPO-1, and he made small batches of BPO-1 (Tr. 669-76; DTX152, DTX153, DTX154). By late 2008, the defendant was focused on BPO-1 as its lead gas barrier additive (Tr. 708).

8. On December 9, 2008, the defendant filed U.S. Provisional Patent Application Serial No. 61/121,034 ("the '034 Provisional Application"), entitled "PET Container and Compositions Having Enhanced Mechanical Properties and Gas Barrier Properties" (J4). The '034 Provisional Application identified and disclosed a container comprising a polyester and various classes of creep control agents, in an amount of about 200-2000 ppm, such

that the polyester container is substantially free of haze and color, and a "Formula II"⁵ gas barrier additive (J4 at -4428 through -4439).

9. The '034 Provisional Application identified and disclosed a molecular structure for gas barrier additive compounds generally known as Formula II:

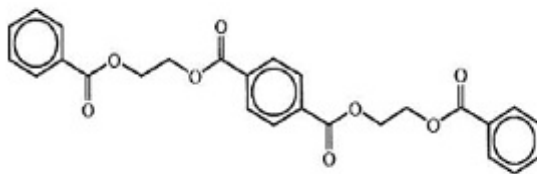


(Tr. 58, 74-75, 217; J4 at -4412).

10. The '034 Provisional Application included five specific structures of gas barrier additives falling within Formula II: (1) dicyclohexyl terephthalate ("DCT") (J4 at -4417, ¶0086); (2) dicyclohexyl isophthalate ("DCI") (J4 at -4418, ¶0086); (3) dicyclohexyl naphthalene-2,6-dicarboxylate ("DCN") (J4 at -4418, ¶0087); (4) bis(2-benzoyloxy)ethyl terephthalate ("BPO-1") (J4 at -4420, ¶0091), and (5) bis(2-benzoyloxy)ethyl'-ethane-1,2-diyl diisophthalate ("BPO-2") (J4 at -4422, ¶0095).

11. Of those five molecules, only one worked sufficiently as a gas barrier additive: BPO-1 (Tr. 78-86, 440-42).

12. The '034 Provisional Application provides the chemical structure of BPO-1:



(Tr. J4 at -4420, ¶0091).

⁵Claim 13 refers to Formula B, but throughout the trial, it was referred to as Formula II.

Collaboration with Ethox

13. In 2009, the defendant began trying to commercialize BPO-1 by looking for an entity with the capability and capacity to make a product on a large scale, known as a toll manufacturer (Tr. 101, 733-34).

14. A third-party intermediary, PolyTech, identified Ethox as possibly having the capabilities to make BPO-1 on a commercial scale (Tr. 734-35).

15. On May 29, 2009, the first in-person meeting between the defendant's representatives (Dr. Huang, Dr. Kriegel, and Dr. Freeman) and Ethox representatives (Dr. Palmer; Dr. Hinton; Philip Howard, the Vice President of Operations; and Chris Welch, the Director of Sales) occurred at Ethox (PTX16, PTX185; Tr. 96, 122-23, 267-72).

16. During that first meeting, the defendant asked Ethox to make in a commercially-feasible way a compound known as BHET, which is an intermediate to BPO-1, and to make BPO-1 for use in PET bottles (PTX185; Tr. 98-100, 123-25, 267-71, 734-735).

17. One of the reasons the defendant approached Ethox was because the defendant's proposed process for making BPO-1 involved ethylene oxide chemistry, i.e., ethoxylation, a distinct area of chemical specialization possessed by Ethox (Tr. 98, 120, 124, 171).

18. During the first meeting between the defendant and Ethox, which Dr. Tanner did not attend, Ethox was shown the structures for BHET and BPO-1, but not the structure for Formula II (Tr. 125-26, 174-76, 179-80, 269-72).

19. Shortly after the first meeting, Ethox's Dr. Palmer met with Dr. Tanner and explained the defendant's gas barrier additive project, including the process proposed by the defendant and Dr. Palmer's initial thoughts on how to arrive at BPO-1 (Tr. 121, 172-73, 268-69, 273-74).

20. Over the next several weeks, during which time the defendant and Ethox representatives stayed in periodic contact, Dr. Tanner worked on the BPO-1 gas barrier additive project (Tr. 176-78, 180-83, 272-74).

21. By August 26, 2009, Dr. Tanner and Ethox came to the conclusion that, while they could make BHET and BPO-1, they could not do so in a commercially-feasible manner (Tr. 126, 183, 274).

PEM

22. Shortly before a teleconference scheduled for August 26, 2009, between the defendant and Ethox, Dr. Tanner informed Dr. Palmer that he had developed an alternative to BPO-1, which Dr. Tanner believed would work as a gas barrier additive in PET bottles (Tr. 184-87, 274, 277-78).

23. The alternative developed by Dr. Tanner is bis(2-phenoxyethyl) terephthalate ("PEM") for use as a gas barrier additive in PET bottles (Tr. 36, 103-104, 126-27, 165-66, 187, 274, 310; J3).

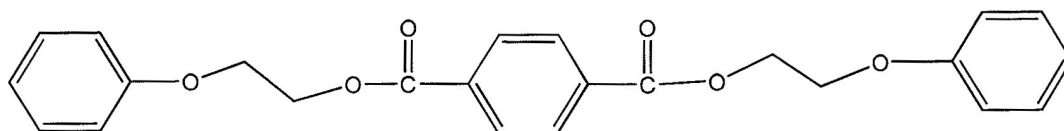
24. Dr. Tanner came up with PEM by thinking about the major processes involved, possible starting materials, and the economic concerns, and by applying his knowledge of reaction chemistry and determining what might work (Tr. 184).

25. Upon seeing the structure for PEM, Dr. Palmer considered PEM an extremely attractive alternative to BPO-1, at least because PEM could be made at a high purity and low cost - issues that plagued the synthesis routes for BPO-1 (Tr. 274-77).

26. Dr. Palmer instructed Dr. Tanner to tell the defendant about PEM, and Dr. Hinton approved the disclosure (Tr. 127, 186-87, 277).

27. During the August 26, 2009, teleconference between the defendant and Ethox, Dr. Tanner and Ethox formally conveyed their conclusion that they could not make BPO-1 in a commercially-feasible manner, but that Dr. Tanner had developed an alternative to BPO-1 (J3; Tr. 277).

28. Shortly after the conclusion of the August 26, 2009, teleconference between the defendant and Ethox, Dr. Tanner sent an email with the structure for PEM to Dr. Freeman, copying Dr. Palmer and Mr. Welch:



(J3; Tr. 126-27, 187-88, 277-78).

29. The first time any of Drs. Kriegel, Huang, Schiavone, and Freeman saw the specific structure for PEM was on August 26, 2009, via the email sent by Dr. Tanner (Tr. 38-42, 760-61; PTX201 at 17; PTX203 at 1).

30. On August 31, 2009, Dr. Freeman sent an email back to Dr. Tanner (copying Drs. Huang, Schiavone, and Kriegel, and Mr. Welch, Dr. Palmer, and Marion Andrews, a co-owner of PolyTech), stating that the PEM "molecule falls well into the family of structures that are of interest to [the defendant]. The next steps would be to understand the cost structure around production, and to provide [the defendant] with a high purity sample, so that [the defendant] can investigate whether it meets [the defendant's] performance requirements" (PTX11; Tr. 96, 128, 192-93, 278).

31. Shortly after receiving the August 31, 2009, email from Dr. Freeman, Dr. Palmer instructed Dr. Tanner to ensure PEM and Dr. Tanner's routes for making PEM were recorded in Dr. Tanner's laboratory notebook (J2; Tr. 194-97, 279-81).

32. On September 1, 2009, Dr. Tanner sent an email to Mr. Welch (copying Drs. Holland, Hinton, and Palmer) setting forth proposed methods for making PEM (PTX199).

33. By September 2, 2009, Dr. Tanner recorded in his laboratory notebook not only the structure for PEM, but two methods for making PEM (J2 at -1 to -2; Tr. 194-97, 224).

34. Dr. Tanner's laboratory notebook entries are dated and witnessed (J2 at -1 to -6).

35. On September 9, 2009, Dr. Tanner synthesized a sample of PEM for the defendant to test and shipped that sample, identified as "JTT-7-87," which stands for James T. Tanner, Page 87 of Tanner Notebook #7, to the defendant (J2 at -2; Tr. 194-99).

36. The defendant tested the sample and determined it was 99.4% PEM (PTX24, PTX41 at 3, PTX77; Tr. 199-204).

37. The defendant also conducted additional testing of PEM samples, the results of which demonstrated that PEM worked as a gas barrier additive (PTX36, PTX129.7; Tr. 201-202, 207-208). As noted below, the defendant later included the same PEM testing results from the Ethox samples in the patent application that issued as the '265 Patent (J7 at -4521).

38. On October 15, 2009, Dr. Tanner emailed Dr. Freeman providing two naphthalene end-capped structures as additional alternatives to BPO-1 (J2 at -3, PTX77; Tr. 129, 204-206, 280-82).

39. On October 19, 2009, Dr. Freeman informed Dr. Tanner that the two additional alternatives to BPO-1 "would definitely be of interest" to the defendant (PTX129.6; Tr. 206, 282-83).

40. By October 22, 2009, Dr. Tanner recorded in his laboratory notebook the two structures for the additional alternatives (J2 at -3 to -4; Tr. 202, 280-82).

The '657 Application

41. On December 2, 2009, the defendant filed nonprovisional U.S. Patent Application Serial No. 12/629,657 ("the '657 Application") (J7).

42. The '657 Application claims priority to the '034 Provisional Application (J1, cover, item (60); J4).

43. The '265 Patent later issued from the '657 Application (J1, cover, items (21), (22), and (45)).

44. The '657 Application added content including that found in the issued '265 Patent at: column 20, line 51 to column 21, line 25; column 27, line 35 to column 28, line 52; and column 33, line 29 to column 36, line 36 ("the added material") (*Compare* J4 to J1; *see also* PTX8, PTX198; Tr. 75-79, 84-87, 212-15).

45. In the '657 Application, the defendant disclosed the same PEM testing results from the Ethox samples referenced in paragraph 37 above, without notifying the plaintiffs:

As the foregoing illustrates, the addition of the gas barrier additives to the polyester significantly enhanced the shelf-life

and gas barrier properties of containers as compared to the containers prepared from polyester without the gas barrier additives. Surprisingly, the addition of just 3 wt. % of PEM-1 increased the container BIF by nearly 20% (1.18) and the shelf-life by two weeks.

(J7 at -4521; J1 at col. 35, Table 7).

46. Included within the added material is the chemical name for PEM, (bis(2-phenoxyethyl)terephthalate), the structure of PEM, PEM-based data, and genericized structures for PEM (J1 at col. 27, l. 35 to col. 28, l. 52 and col. 33, l. 29 to col. 36, l. 36; see *also* PTX8; Tr. 75-79, 84-87, 212-15).

47. Prior to December 2, 2009, the defendant did not inform Dr. Tanner or any Ethox representative that the defendant intended to add the chemical name for PEM, (bis(2-phenoxyethyl)terephthalate), the structure of PEM, PEM-based data, and genericized structures for PEM to the defendant's '034 Provisional Application and file the supplemented document as a utility patent application (Tr. 208-209, 215, 284, 326-27).

48. After December 2, 2009, the defendant did not inform Dr. Tanner or any Ethox representative that the defendant added the chemical name for PEM, (bis(2-phenoxyethyl)terephthalate), the structure of PEM, PEM-based data, and genericized structures for PEM to the defendant's '034 Provisional Application and filed the supplemented document as a utility patent application (Tr. 133-34, 209-10, 326-27). As will be discussed below, on December 31, 2010, Dr. Tanner found the published application underlying the '265 Patent (PTX8, PTX164; Tr. 134, 210-13, 291-96).

Stepan

49. The defendant had not stopped searching for toll manufacturers to make BPO-1 because it believed that BPO-1 still had the best chance of performing as a gas barrier additive (Tr. 741-42).

50. Another consultancy firm for the defendant identified Stepan Company ("Stepan") as a toll manufacturer with the capability to make BPO-1. In November 2009, the defendant began working separately and independently with Stepan to evaluate the feasibility of

manufacturing BPO-1 on a commercial scale (Tr. 741-42; DTX358 at 50-53, 85, 298-99, 308).

51. Stepan, like Ethox, is a highly specialized chemical company whose scientists possess more than ordinary skill (Tr. 528-30, 876-77, 880). Rick Tabor, with a bachelor's degree in chemistry, was a scientist at Stepan (DTX358 at 307-308).

52. During the defendant's initial communication with Stepan, the defendant provided Stepan with a Project Brief containing the structure of BPO-1, synthetic pathways for making BPO-1, its intended application as a gas barrier additive in PET resin, and related technical know-how (Tr. 741-42; DTX358 at 50-53, 85, 298-99, 308; DTX181). The defendant did not disclose anything about PEM, which Ethox was working on separately (Tr. 743; DTX358 at 309-10).

53. In early January 2010, Stepan determined that it could not make BPO-1 within the defendant's commercialization targets (Tr. 743; DTX358 at 302-304, 308; DTX181, DTX263). Stepan suggested six alternative structures. Of those six, three were the same as the alternatives proposed by Ethox; PEM was the first listed, and the third and fourth listed were identical to the naphthalene end-capped structures Dr. Tanner had suggested in his email dated October 15, 2009 (Tr. 743-746; J3; DTX24; DTX72; DTX263; DTX358 at 142-44, 182, 184-85, 304-305, 309-10). Dr. O'Brien testified that Rick Tabor was the Stepan chemist who identified these alternatives (DTX358 at 304-305; DTX263).

Continuing Relationship Between the Parties

54. The collaboration between Ethox and the defendant continued after Dr. Tanner provided the PEM structure to the defendant (Tr. 128-30, 134, 283-84, 289-90, 292).

55. On February 22, 2010, a second in-person meeting was held between the defendant's representatives (at least Dr. Kriegel, Dr. Freeman, Dr. Forrest Bayer, and Mr. Knutzen) and Ethox's representatives (Dr. Palmer and Mr. Welch) (PTX158, PTX 164, PTX200; Tr. 130-32, 284-85).

56. During the February 22, 2010, meeting, the defendant displayed several slides, including one showing the structures for BPO-1 and PEM, stating at the bottom of the slide,

"Both molecules are part of a family of molecules covered in TCCC patent application" (PTX41, PTX200; Tr. 287-90).

57. The defendant did not tell Ethox during this second meeting to what patent application the slide was referring or provide any details on the application (PTX41, PTX159, PTX200; Tr. 132, 211-12, 287-91).

58. On November 18, 2010, a third in-person meeting between the defendant's representatives (Dr. Huang and Dr. Freeman) and Ethox's representatives (Dr. Palmer, Dr. Tanner, and Mr. Welch) was held (PTX191; Tr. 292-94).

59. During the November 18, 2010, meeting, the defendant displayed several slides, including one setting forth purity data for PEM samples (with purity for Ethox's PEM sample listed as 93.96) and one showing the structures for BPO-1 and PEM, stating at the bottom of the slide, "Both molecules are part of a family of molecules covered in TCCC patent application" (PTX29 at 2, 4; Tr. 294).

60. The defendant did not tell Ethox during this third meeting to what patent application the slide was referring or provide any details on the application (Tr. 134, 211-12, 294).

61. On December 31, 2010, Dr. Tanner found the published '657 Application underlying the '265 Patent, noting that it "covered the PEM molecule and . . . reported the gas barrier data" (PTX8, PTX164; Tr. 134, 210-13, 291-96).

62. The first time the plaintiffs learned of Formula II occurred when Dr. Tanner discovered the published '657 Application on December 31, 2010 (Tr. 179-80, 210-11, 244).

63. On February 14, 2011, Dr. Palmer wrote an email and letter to Dr. Freeman alerting the defendant that the plaintiffs had discovered the published '657 Application underlying the '265 Patent and noting that it, unlike the '034 Provisional Application, disclosed the PEM molecule. Dr. Palmer asked how the oversight in failing to list Dr. Tanner as a co-inventor had occurred. The letter requested a response by March 4, 2011 (PTX30, PTX165; Tr. 296-98).

64. On March 9, 2011, Dr. Hinton wrote to the defendant's Chief Executive Officer, Mr. Muhtar Kent, alerting Mr. Kent of the February 14, 2011, correspondence and the lack of

response, and requesting that a response be received by March 18, 2011 (PTX166; Tr. 134-36, 298).

65. Later on March 9, 2011, Dr. Freeman responded via email to Dr. Palmer's original email and letter and indicated that an "appropriate response . . . will be sent to you by the end of the week" (PTX192; Tr. 135, 298-99).

66. On March 11, 2011, intellectual property counsel for the defendant responded to Dr. Palmer (PTX193; Tr. 299). The letter made clear that the defendant did not recognize Dr. Tanner as a co-inventor, asserting that Formula II was shown to Ethox during the first May 29, 2009, meeting and that Dr. Tanner's contribution of PEM was merely a reduction to practice of the defendant's Formula II invention (PTX193; Tr. 299-300).

67. In the March 11, 2011, letter, the defendant's intellectual property counsel recognized that Formula II is a "genus" (PTX193).

68. In their expert reports and testimony, both the plaintiffs' and the defendant's patent experts also described Claim I, which contains Formula II, as a genus claim with Claim 11 being a subgenus claim (Tr. 575, 967-68); although the defendant's expert, Mr. Doll, also testified that Formula II could be considered as a "Markush group" (Tr. 967-72, 975-78). "The [Manual of Patent Examining Procedure] ["MPEP"] defines a Markush group as 'any claim that recites a list of alternatively useable species regardless of format.'" *Sri International, Inc. v. Dell Inc.*, Civ. Nos. 13-737-SLR, 13-1534-SLR, 2015 WL 2265756, at 3 (D. Del. May 14, 2015) (citing MPEP § 2173.05(h)). Mr. Doll acknowledged that it is "very common to interchange" the terms genus and Markush group (Tr. 969).

69. A fourth and final in-person meeting between the defendant and Ethox occurred on March 31, 2011, but the parties were not able to resolve their inventorship dispute (PTX194; Tr. 136).

The '265 Patent

70. The '265 Patent issued on February 7, 2012, from the '657 Application (J1, cover, items (21), (22), and (45)).

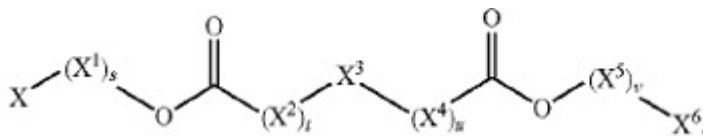
71. The '265 Patent lists five inventors: Robert Kriegel, Xiaoyan Huang, Robert Schiavone, T. Edwin Freeman, and Mihaela Penescu (J1, cover).

72. The '265 Patent is a combination patent, as the individual elements of its claims - polyester containers, creep control agents, and gas barrier additives - were known in the art (See, e.g., Tr. 679-81, 683-85).

73. The '265 Patent issued with twenty-one claims, and this dispute focuses on Claims 1 and 11 of the '265 Patent (J1, col. 36, l. 38 to col. 48, l. 53).

74. Claim 1 of the '265 Patent is directed to a container comprising a polyester composition, a creep control agent, and gas barrier additive "wherein the gas barrier enhancing additive comprises a compound having the chemical structure of" Formula I or Formula II (See J1, col. 36, l. 37 to col. 48, l. 53; see also Tr. 705).

75. Formula II of the '265 Patent is:



(J1, col. 19, l. 50-col. 20, l. 14; col. 37, ll. 14-59).

76. When the '657 Application was filed, it included Claim 21, directed to a genericized version of PEM as the gas barrier additive, and Claim 22, directed to PEM as the gas barrier additive (PTX8 at 25; PTX39 at 1, 21-22).

77. On August 10, 2011, after the '657 Application published (publication occurred on June 10, 2010), the defendant amended Claim 21 to change the genericized PEM information to require that "X and X⁶ each comprise an phenoxy group" and amended Claim 22 to remove the PEM structure and specify that "X3 comprises a divalent benzene" (PTX39 at 1, 21-22).

78. Claims 21 and 22 of the '657 Application issued respectively as Claims 11 and 12 of the '265 Patent (Compare Ex. PTX39 at 1, 22, 23 with J1 at col. 40, ll. 1-6).

79. Claim 11 of the '265 Patent depends from Claim 1 and specifies that "the gas barrier additive comprises a compound having the chemical structure of Formula II, wherein X and X⁶ each comprise an phenoxy group" (J1, col. 40, ll. 1-4).

80. Prior to Dr. Tanner's involvement in the BPO-1 project, as noted above, the defendant filed the '034 Provisional Application on December 9, 2008 (J1, cover, item (60); *see also* J4).

81. Formula II in the '034 Provisional Application is the same as Formula II in the '265 Patent (*Compare* J4 at -4412, ¶ 0072 *with* J1 at col. 19, l. 50 to col. 20, l. 16).

82. Formula II includes over 18.5 billion possible compounds (Tr. 464-75, 866-67).

83. Prior to Dr. Tanner's collaboration with the defendant, the defendant had, as evidenced by the '034 Provisional Application, only five specific gas barrier additives that fell under Formula II: (1) dicyclohexyl terephthalate ("DCT") (J4 at -4417, ¶0086); (2) dicyclohexyl isophthalate ("DCI") (J4 at -4418, ¶0086); (3) dicyclohexyl naphthalene-2,6-dicarboxylate ("DCN") (J4 at -4418, ¶0087); (4) bis(2-benzoyloxy)ethyl terephthalate ("BPO-1") (J4 at -4420, ¶0091); and (5) bis(2-benzoyloxy)ethyl'-ethane-1,2-diyl diisophthalate ("BPO-2") (J4 at -4422, ¶0095).

84. None of DCT, DCI, DCN, BPO-1, and BPO-2 have terminal phenoxy groups in the X and X⁶ positions (Tr. 86, 438-40, 872-75).

85. Prior to Dr. Tanner's collaboration with the defendant, the defendant did not have any specific structure falling under Formula II that has terminal phenoxy groups (Tr. 84-86, 438-40, 872-75).

86. After Dr. Tanner's collaboration with the defendant, the defendant published in the nonprovisional '657 Application the specific structure falling under Formula II that has terminal phenoxy groups, PEM (J1 at col. 27, l. 35 to col. 28, l. 52 and col. 33, l. 29 to col. 36, l. 36; *see also* PTX8; Tr. 75-79, 84-87, 212-15).

CONCLUSIONS OF LAW

1. Principles of Inventorship

a. Co-Inventorship

87. Determining whether a person is a co-inventor is fact-specific inquiry, and no bright-line standard suffices in every case. See *Bard Peripheral Vascular, Inc. v. W.L. Gore & Assocs., Inc.*, 776 F.3d 837, 845 (Fed. Cir. 2015) (citing *Fina Oil*, 123 F.3d at 1473).

88. To rebut the presumption that the named inventors are the true and only inventors, clear and convincing evidence that the alleged unnamed inventor was in fact a co-inventor must be found before inventorship is corrected under 35 U.S.C. § 256. See *Caterpillar Inc. v. Sturman Indus., Inc.*, 387 F.3d 1358, 1377 (Fed. Cir. 2004) (citing *Pannu v. Iolab Corp.*, 155 F.3d 1344, 1350 (Fed. Cir. 1998)).

89. To satisfy the clear and convincing standard, a co-inventor's testimony standing alone does not suffice - corroboration of his testimony is needed, which is evaluated under a rule of reason analysis. See *id.* (citing *Ethicon, Inc. v. United States Surgical Corp.*, 135 F.3d 1456, 1460 (Fed. Cir. 1998)); see also *Linear Tech. Corp. v. Impala Linear Corp.*, 379 F.3d 1311, 1327 (Fed. Cir. 2004); see also *Price v. Symsek*, 988 F.2d 1187, 1195 (Fed. Cir. 1993) (explaining that the rule of reason requires an "evaluation of all pertinent evidence be made so that a sound determination of the credibility of the inventor's story may be reached").

90. A person is "a joint inventor only if he contributes to the conception of the claimed invention." *Eli Lilly & Co. v. Aradigm Corp.*, 376 F.3d 1352, 1359 (Fed. Cir. 2004); see also *Ethicon*, 135 F.3d at 1460.

91. "Conception" is "the touchstone of inventorship," and occurs via "the formation in the mind of the inventor, of a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice." *Burroughs Wellcome Co. v. Barr Labs., Inc.*, 40 F.3d 1223, 1227-28 (Fed. Cir. 1994).

92. "Conception is complete only when the idea is so clearly defined in the inventor's mind that only ordinary skill would be necessary to reduce the invention to practice, without extensive research or experimentation." *Id.* at 1228.

93. Because "conception is the touchstone of inventorship, each joint inventor must generally contribute to the conception of the invention," and "each needs to perform only a part of the task which produces the invention." *Ethicon, Inc.* 135 F.3d at 1460 (citing *Burroughs*, 40 F.3d at 1227-28); see *Fina Oil*, 123 F.3d at 1473 (noting that "[o]ne need not alone conceive of the entire invention, for this would obviate the concept of joint invention."); see also *Monsanto v. Kamp*, 269 F. Supp. 818, 824 (D.D.C. 1967) (explaining that "it is not necessary that the entire inventive concept should occur to each of the joint inventors, or that the two should physically work on the same project together . . . The fact that each of the inventors plays a different role and that the contribution of one may not be as great as that of another, does not detract from the fact that the invention is joint, if each makes some original contribution, though partial, to the final solution of the problem.").

94. "Because co-inventors need not 'make a contribution to the subject matter of every claim of the patent,' 35 U.S.C. § 116, inventorship is determined on a claim-by-claim basis." *Trovan, Ltd. v. Sokymat SA*, 299 F.3d 1292, 1302 (Fed. Cir. 2002); see also *Kimberly-Clark Corp. v. The Proctor & Gamble Distrib. Co.*, 973 F.2d 911, 917 (Fed. Cir. 1992).

b. Conception For Chemical Inventions

95. For chemical inventions, conception "does not occur unless one has a mental picture of the structure of the chemical," and generally requires "knowledge of both the specific chemical structure of the compound and an operative method of making it." *Vanderbilt Univ. v. ICOS Corp.*, 601 F.3d 1297, 1301 (Fed. Cir. 2010) (quoting *Vanderbilt Univ. v. ICOS Corp.*, 594 F.Supp.2d 482, 504, (D. De. 2009)). See *Burroughs*, 40 F.3d at 1229-30.

96. Conception of a chemical invention requires description by "whatever characteristics sufficiently distinguish it," such as "the structure of the chemical," or "its method of preparation, [or] its physical or chemical properties." *Amgen, Inc. v. Chugai Pharm. Co.*,

Ltd., 927 F.2d 1200, 1206 (Fed. Cir. 1991); see *Falana v. Kent State Univ.*, 669 F.3d 1349, 1358 (Fed. Cir. 2012) (district court concluded that the co-inventor's contribution of a method of making a subset of a genus was "greater than the exercise of ordinary skill"); see also *Fiers v. Revel*, 984 F.2d 1164, 1169 (Fed. Cir. 1993) (noting that "conception of any chemical substance, requires a definition of that substance other than by its functional utility").

97. "One shows that one is 'in possession' of *the invention* by describing the invention, with all its claimed limitations, not that which makes it obvious." *Lockwood v. American Airlines, Inc.*, 107 F.3d 1565, 1572 (Fed. Cir. 1997) (emphasis original).

c. Genus and Species

98. Conception of a genus of compounds and a species therein does not necessarily amount to conception of a different species within the genus. See, e.g., *Oka v. Youssefyeh*, 849 F.2d 581, 584 (Fed. Cir. 1988).

99. Even if an inventor "envision[s] the structure of a novel genus of chemical compounds and contributes the method of making that genus," that still "does not mean that such an inventor necessarily has a right to claim inventorship of all species within that genus which are discovered in the future." *Falana*, 669 F.3d at 1358.

100. Knowledge of the "properties of groups of complex chemical compounds is insufficient to confer inventorship status with respect to specifically claimed compounds." *Bd. of Educ. ex rel. Bd. of Trustees of Fla. State Univ. v. Am. Bioscience*, 333 F.3d 1330, 1340 (Fed. Cir. 2003) (hereinafter "*Bioscience*").

101. "One must have a conception of the specific compounds being claimed, with all of their component substituents." *Id.*

102. A person may be deemed a co-inventor even if he does not conceive of the structure of a specific compound falling within a genus, but merely contributes a method of making a subset of the genus. *Falana*, 669 F.3d at 1359.

d. Collaboration

103. The Patent Act allows for joint inventorship even where the co-inventors "did not physically work together." 35 U.S.C. § 116.

104. Co-inventors must collaborate and work together to collectively have a definite and permanent idea of the complete invention. See *Bard*, 776 F.3d at 846 (citing *Burroughs*, 40 F.3d at 1229 and *Vanderbilt Univ.*, 601 F.3d at 1308).

105. Co-inventors are deemed to have sufficiently collaborated where "the inventors have some open line of communication during or in temporal proximity to their inventive efforts." *Eli Lilly*, 376 F.3d at 1359; *Falana*, 669 F.3d at 1358.

e. Claim Scope

106. The "scope of a claim must be known before the contributions of an alleged co-inventor can be compared to that claim to determine whether the correct inventors were named." *Eli Lilly*, 376 F.3d at 1360.

f. Contribution That is Not Insignificant

107. If one merely explains well-known concepts and/or the current state of the art, then that person is not a co-inventor. See *Bard*, 776 F.3d at 845 (citing *Pannu*, 155 F.3d at 1351); see also *Nartron Corp. v. Schukra U.S.A. Inc.*, 558 F.3d 1352, 1356 (Fed. Cir. 2009); see also *Caterpillar*, 387 F.3d at 1377.

108. To qualify as a co-inventor, "a joint inventor's contribution must be 'not insignificant in quality, when that contribution is measured against the dimension of the full invention.'" *Bard*, 776 F.3d at 845 (quoting *Fina*, 123 F.3d at 1473).

109. If one supplies only one "component essential to an invention, that is an insufficiently significant contribution if the component and the principles of its use were known in the prior art." *Id.* (citing *Hess v. Advanced Cardiovascular Sys., Inc.*, 106 F.3d 976, 980 (Fed. Cir. 1997)).

g. New and Non-Obvious Combination of Old Elements

110. An invention can be based upon a new and nonobvious combination of old elements. See, e.g., *Leo Pharm. Prods., Ltd. v. Rea*, 726 F.3d 1346, 1353, 1356, 1359 (Fed. Cir.

2013); see also *Nartron*, 558 F.3d at 1358 (noting that one who suggests a non-obvious combination of prior art elements to the named inventors can be a co-inventor); *Tavory v. NTP, Inc.*, 297 F. App'x 976, 980 (Fed. Cir. 2008).

111. "Patentability shall not be negated by the manner in which the invention was made." 35 U.S.C. § 103(a).

112. In fact, "[t]he genius of invention is often a combination of known elements which in hindsight seems preordained." *Cheese Sys., Inc. v. Tetra Pak Cheese & Powder Sys., Inc.*, 725 F.3d 1341, 1353 (Fed. Cir. 2013) (citing *McGinley v. Franklin Sports, Inc.*, 262 F.3d 1339, 1351 (Fed. Cir. 2001)). See also *Power Integrations, Inc. v. Fairchild Semiconductor Int'l, Inc.*, 711 F.3d 1348, 1368 (Fed. Cir. 2013)).

113. Thus, "[a] factfinder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon ex post reasoning." *Outside the Box Innovations, LLC v. Travel Caddy, Inc.*, 695 F.3d 1285, 1298 (Fed. Cir. 2012) (citing *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007)); see also *Diamond Rubber Co. of New York v. Consol. Rubber Tire Co.*, 220 U.S. 428, 433-35 (1911) (cautioning that "[m]any things, and the patent law abounds in illustrations, seem obvious after they have been done, and, in the light of the accomplished result, it is often a matter of wonder how they so long eluded the search of the discoverer and set at defiance the speculations of inventive genius." (quotation omitted)); see also *Arkie Lures, Inc. v. Gene Larew Tackle, Inc.*, 119 F.3d 953, 956 (Fed. Cir. 1997) (stating that "[g]ood ideas may well appear 'obvious' after they have been disclosed, despite having been previously unrecognized.").

2. Dr. Tanner is a Co-inventor of the '265 Patent

a. Collaboration, Conception, and Corroboration

114. Dr. Tanner collaborated with the defendant and specifically with Dr. Freeman, who is one of the named inventors; conceived of PEM; and that conception was corroborated (J2, PTX185, PTX199; Tr. 43, 97, 102-103, 126, 165-66, 187-88, 194-97, 274, 278-81).

115. In this field of endeavor, conception "does not occur unless one has a mental picture of the structure of the chemical," and generally requires "knowledge of both the specific

chemical structure of the compound and an operative method of making it." *Vanderbilt Univ.*, 601 F.3d at 1301; *Burroughs*, 40 F.3d at 1229.

116. The conception of PEM as a gas barrier additive, requiring the exercise of more than ordinary skill in the art, was complete only when PEM had been described by "whatever characteristics sufficiently distinguish it," such as "the structure of the chemical," or "its method of preparation, [or] its physical or chemical properties." *Amgen, Inc.*, 927 F.2d at 1206; see *Falana*, 669 F.3d at 1358 (district court concluded that the contribution of a method of making a subset of a genus was "greater than the exercise of ordinary skill" and supported determination of co-inventorship); see also *Fiers*, 984 F.2d at 1169 ("conception of any chemical substance, requires a definition of that substance other than by its functional utility").

117. As such, in order for Dr. Tanner to have conceived of this chemical invention, he would need to know not just its functional utility (i.e., its use as a gas barrier additive in PET bottles), but also the specific structure of a gas barrier additive with terminal phenoxy groups, such as PEM.

118. Based on analysis of all evidence presented, Dr. Tanner conceived of PEM, a gas barrier additive with terminal phenoxy groups, and its application as a gas barrier additive in a polyester composition destined to be a container.

b. Substantial Contribution

119. The contribution of PEM is not "insignificant in quality, when that contribution is measured against the dimension of the full invention." See *Nartron*, 558 F.3d at 1356-57 (quoting *Pannu*, 155 F.3d. at 1351).

120. Rather, Dr. Tanner's contribution to the December 2, 2009, application that gave rise to the '265 Patent is substantial, providing the only support for the phenoxy terminal elements in Claim 11 and providing substantial support for Claim 1 of the '265 Patent via the specification in Claim 11.

121. The Federal Circuit has held that knowledge of a genus and a species therein does not, by itself, establish conception of a different species within the genus. *See, e.g., Oka*, 849 F.2d at 584.

122. Thus, in order to have conceived of (and therefore invented) a Formula II gas barrier additive with terminal phenoxy groups, e.g., PEM, possession of the specific compound, with all of its specific substituents, is necessary. *See, e.g., Lockwood*, 107 F.3d at 1572.

123. The defendant's prior knowledge of Formula II or the five specific structures falling within it (none with terminal phenoxy groups) does not rise to the level of invention for Claim 11 because possession of the sub-genus was lacking.

124. It is undisputed that the structure of Formula II exists in the defendant's '034 Provisional Application, which was filed on December 9, 2008, i.e., prior to Dr. Tanner's involvement in the gas barrier additive collaboration (See J1, cover, item (60); *see also* J4).

125. However, Formula II includes over 18.5 billion possible compounds (See Tr. 467-75, 867).

126. Prior to Dr. Tanner's collaboration with the defendant, the defendant had, as evidenced by the '034 Provisional Application, only five specific gas barrier additives - DCT, DCI, DCN, BPO-1, and BPO-2 - that fall under Formula II; none of those molecules have terminal phenoxy groups (Tr. 86, 438-40, 872-75).

127. Prior to Dr. Tanner's collaboration with the defendant, the defendant did not possess the specific structure of PEM (Tr. 38-41, 759-61).

128. Prior to Dr. Tanner's collaboration with the defendant, the defendant did not possess a gas barrier additive falling within Formula II that has terminal phenoxy groups (Tr. 117, 440, 442, 477, 481, 872-74).

129. The first time any of Drs. Kriegel, Huang, Schiavone, and Freeman saw the specific structure for PEM was on August 26, 2009, via the email sent by Dr. Tanner (PTX 201 at 17; PTX203 at 1; Tr. 38-42, 759-61).

130. By extension, the first time any of Drs. Kriegel, Huang, Schiavone, and Freeman saw a gas barrier additive falling within Formula II that has terminal phenoxy groups was on August 26, 2009, via the email sent by Dr. Tanner.

131. The only molecule supporting Claim 11, i.e., a gas barrier additive of Formula II with terminal phenoxy groups, is the Dr. Tanner-originated PEM molecule (Tr. 419, 475, 599).

132. Accordingly, Dr. Tanner is responsible for one of the six (approximately 17%) specific Formula II structures set forth in the '265 Patent that support the claims (Tr. 438-40).

133. Dr. Tanner is responsible for the only (100%) specific Formula II structure set forth in the '265 Patent that supports Claim 11, i.e., having terminal phenoxy groups (Tr. 86, 419, 475, 599).

134. Moreover, the specific structure for PEM, contributed to the collaboration by Dr. Tanner, was significant in getting the claims of the '265 Patent allowed (Tr. 578-79). In allowing the claims of the '265 Patent, the Examiner highlighted that the "prior art fails to teach or suggest applicant's recited container comprising a . . . gas barrier enhancing additive and applicant's recited chemical structures for the . . . gas barrier enhancing additive" (PTX6 at -4796).

c. PEM in Prior Art

135. The defendant cited U.S. Patent No. 3,557,167 to Hulsmann et al. ("Hulsmann") for the theory that a method of synthesizing PEM was known in 1971 (DTX339; Tr. 814-16).

136. The defendant cited U.S. Patent No. 4,705,844 to Espenschied et al. ("Espenschied") for the theory that it was known that PEM could be put into a molded object and that the molded object could be made of PET (DTX340; Tr. 816-17).

137. Neither Hulsmann nor Espenschied disclosed or suggested PEM as a gas barrier additive in PET containers (DTX339, DTX340; Tr. 848-51, 856).

138. The defendant's expert Dr. Long testified that Hulsmann taught a process for synthesis of particular molecules with no mention of containers or how PEM is used, and no description of PEM as a gas barrier additive in PET bottles (Tr. 848-51, 856).

139. Dr. Long also testified that Espenschied fails to say anything about a container, a container with a top on it, gas barrier additives, or PET containers, and it is instead directed to gear wheels, bevel wheels, racks, clutch disks, guide elements, components for electronic equipment and the like (Tr. 851-56; see DTX340, col. 9, ll. 30-35).

140. Dr. Kriegel testified that the structure for BPO-1 is in the prior art (Tr. 688-89, 699-700) as are all of the creep control agents made part of Claim 1 of the '265 Patent (Tr. 49-50; PTX202 at 1), as well as PET containers, which have been around for decades (Tr. 47).

141. Nevertheless, the patent laws permit novel and non-obvious combinations of old elements to be patented. See, e.g., *Leo*, 726 F.3d at 1353, 1356, 1359; see also *Nartron*, 558 F.3d at 1358 (noting that one who suggests a non-obvious combination of prior art elements to the named inventors can be a co-inventor); see also *Tavory*, 297 F. App'x at 980.

d. The Experts

142. The plaintiffs' technical expert, Dr. Geoffrey Coates, is a Ph.D. organic chemist, university professor, and peer-reviewed author and editor with extensive industry and academic experience whose areas of research focus on organic chemistry (including synthesis of polymeric materials and small molecule compounds) and whose particular area of interest is polymer synthesis from bio-renewable resources (PTX17; Tr. 387-93, 420).

143. Dr. Coates is an expert in the fields of synthetic chemistry, organic chemistry, and polymer chemistry (PTX17; Tr. 394).

144. Dr. Coates formed five primary opinions: (1) Dr. Tanner is the person who conceived of the PEM gas barrier additive and contributed it to the collaborative project with the defendant; (2) the named inventors of the '265 Patent did not conceive the PEM gas barrier additive; (3) the inclusion of Formula II in the '034 Provisional Application does not demonstrate conception of the PEM gas barrier additive; (4) Claim 11 of the '265 Patent is directed toward Dr. Tanner's inventive contribution, and the sole support for that claim is the PEM gas barrier additive that Dr. Tanner conceived and contributed; and (5) Dr. Tanner is

an inventor of at least Claim 11 of the '265 Patent, and therefore he should be named as an inventor on the patent (Tr. 418-19, 421-24, 475, 482).

145. The defendant's technical expert, Dr. Timothy Long, is a college professor with a Ph.D. in chemistry with a specialization in polymer chemistry (Tr. 784). He has approximately 30 patents and is an expert in the field of synthetic polymer chemistry and its application to polyethylene terephthalate containers (Tr. 787-89).

146. Dr. Long testified that he believed the PEM molecule to be an obvious variant of BPO-1, while also testifying that he found it remarkable "that Tanner could come up with PEM in a quick fashion" (Tr. 792-93, 882), which is somewhat inconsistent.

147. Similarly, Dr. Long testified that he does not dispute the accuracy of Dr. Coates' calculation that, by just varying the X and X⁶ groups, Formula II encompasses at least 18.5 billion possible compounds (Tr. 467-75, 866-67). Despite this fact, Dr. Long provided an opinion that the PEM molecule would be an obvious selection to one skilled in the art who was provided with Formula II (Tr. 868).

148. In reaching this conclusion, Dr. Long specifically selected the word aryloxy as the group to use at the X and X⁶ positions, and then specifically selected a phenoxy group as the aryloxy group that he would choose (Tr. 869-71).

149. Yet Dr. Long admits that the '034 Provisional Application lists almost 40 possible groups that could be employed at the X and X⁶ positions, with "aryloxy" just being one of the options in that list, and he further admits that, even if one were to select an aryloxy group, there are many possible aryloxy groups that could be used, and that the word phenoxy does not appear in the '034 Provisional Application, nor does any structure that contains a phenoxy group (Tr. 870-75).

150. The plaintiffs' patent expert, Mr. Stephen Kunin, is an attorney with over 45 years of experience in the patent field, having worked in various capacities at the United States Patent and Trademark Office ("USPTO") including as a patent examiner, supervisory examiner, patent examining group director, Assistant Commissioner for Patents, and Deputy Commissioner for Patent Examination Policy (PTX20 at 1; Tr. 536-37). In the last

of those roles, Mr. Kunin was principally responsible for examination policies and rules of practice of the USPTO, as well as the Manual of Patent Examining Procedure (Tr. 537). He is now in private practice as a partner in a law firm (PTX20 at 1-2; Tr. 535-36).

151. Mr. Kunin confirmed Dr. Coates' opinions that: (1) Dr. Tanner is the person who conceived of the PEM gas barrier additive and contributed it to the collaborative project with the defendant; (2) the named inventors of the '265 Patent did not conceive the PEM gas barrier additive; (3) the inclusion of Formula II in the '034 Provisional Application does not demonstrate conception of the PEM gas barrier additive; (4) Claim 11 of the '265 Patent is directed toward Dr. Tanner's inventive contribution, and the sole support for that claim is the PEM gas barrier additive that Dr. Tanner conceived and contributed; and (5) Dr. Tanner is an inventor of at least Claim 11 of the '265 Patent, and therefore he should be named as an inventor on the patent (Tr. 541-44, 564-69).

152. The defendant's patent expert, Mr. John Doll, has a master's degree in chemistry and physical chemistry (Tr. 936-37) and worked for the USPTO for approximately 30 years, beginning as a primary examiner in chemical arts and eventually becoming the Commissioner of Patents, Deputy Undersecretary and Deputy Director of the USPTO, and then Acting Undersecretary and Acting Director of the USPTO (Tr. 937-8).

153. Mr. Doll concluded that Dr. Tanner is not an inventor of the '265 Patent in part because PEM is an obvious structural variant of BPO-1, Formula II encompassed PEM, and PEM was in the prior art (Tr. 943-44, 953).

154. At trial, Mr. Doll testified that Formula II should be characterized as a limited Markush group (Tr. 968). However, in his expert report, like Mr. Kunin, Mr. Doll described Claim 11 as a subgenus of the broader genus of Claim 1 (Tr. 968, 975-78). On cross-examination, Mr. Doll testified that a Markush claim is not "open-ended" as a genus is (Tr. 968).

155. Mr. Doll acknowledged that it is "very common to interchange" the terms genus and Markush group (Tr. 969), but he is the only witness to have mentioned a Markush group. Notably, the defendant's intellectual property counsel recognized that Formula II is a

"genus" (PTX193). To the extent Mr. Doll was making a distinction, the evidence does not support such in this case.

156. Overall, the court finds the testimony of Dr. Coates and Mr. Kunin more persuasive than that of the defendant's experts. Based upon the evidence presented at trial, the court finds that Claim 11 is a subgenus claim of the broader genus claim in Claim 1, which contains Formula II (Tr. 565-66). The only molecule supporting Claim 11, i.e., a gas barrier additive having the chemical structure of Formula II with terminal phenoxy groups, is the Dr. Tanner-originated PEM molecule (Tr. 419, 475, 599).

e. More than Ordinary Skill in the Art

157. By the time the defendant started its collaboration with Ethox in late May 2009, it had been attempting to improve gas barrier additives for PET bottles for over four years (Tr. 55-56, 641-42, 729-30).

158. Based upon that extensive research, the defendant designated BPO-1 as its primary target (Tr. 99, 267-68, 733-34).

159. The defendant approached Ethox to make BPO-1 due to Ethox's specialized chemical knowledge (Tr. 98-99, 124, 171; PTX16).

160. Dr. Tanner is a sophisticated ester chemist who, prior to the collaboration with the defendant, had experience with ethoxylation chemistry, i.e., the type of chemistry required to synthesize BPO-1 (Tr. 121, 168-69, 171).

161. Despite the fact that the defendant's scientists had been working on improving gas barrier additives for over four years, none of them came up with PEM as a gas barrier additive for PET bottles (Tr. 429-32, 530-31, 675-76, 696-97, 729-30), which evidences that doing so required more than the exercise of ordinary skill in the art (Tr. 25-26, 274-77, 641-42, 669-70, 709, 729-30).

162. While Mr. Tabor, who has a bachelor's degree in chemistry rather than Ph.D., later came up with PEM, the evidence shows that Mr. Tabor was a scientist within Stepan, a company that, like Ethox, is a highly-specialized chemical company with expertise in

ethoxylation and whose scientists possess more than ordinary skill in the art (Tr. 528-30, 876-77, 880).

f. Structures of PEM and BPO-1

163. While the defendant contends that PEM is an obvious variant of BPO-1 as a gas barrier additive, and, therefore, Dr. Tanner simply exercised ordinary skill in identifying PEM, the molecules differ significantly: PEM possesses two ester linkages and two ether linkages, while BPO-1 possesses four ester linkages and no ether linkages. Moreover, PEM has terminal phenoxy groups, while BPO-1 does not (Tr. 444-45, 485, 512, 522-23).

164. The structural differences between BPO-1 and PEM would impart different functionalities to the two molecules, e.g., their reactivities with other molecules would differ significantly and that to effectuate this significant structural change requires that the chemist produce the PEM molecule using different starting materials and process steps than are used to produce BPO-1 (See Tr. 444-56, 523-25; see *also* Tr. 189-91).

165. Both of the parties' technical experts testified that BPO-1 and PEM differ in that PEM contains two fewer carbonyl groups than BPO-1 and further testified that this structural change will impact the functionality of the PEM molecule by making it less reactive than the BPO-1 molecule (Tr. 444-45, 511, 806-807).

166. Even if PEM is considered structurally similar to BPO-1, that does not hinder Dr. Tanner's inventive contribution because there is no evidence that the defendant (or anyone else) possessed PEM as a gas barrier additive at the time Dr. Tanner provided it to the defendant.

g. Stepan's Arrival at PEM

167. That Stepan also purportedly invented PEM as a gas barrier additive does not hinder Dr. Tanner's inventive contribution.

168. As noted above, while Mr. Tabor is not a Ph.D. in polymer science, the court finds the testimony persuasive that Stepan, like Ethox, is a highly-specialized chemical company with expertise in ethoxylation and whose scientists possess more than ordinary skill in the art (Tr. 528-30, 876-77, 880).

169. Stepan's arrival at PEM as a gas barrier additive occurred in January 2010, i.e., after Dr. Tanner conceived of PEM as a gas barrier additive and a method to make PEM, and after the defendant put PEM in the '657 Application (Tr. 758, 772-73, 875; DTX72).

h. Prosecution of Ethox's Patent Application

170. The defendant argues that the rejection of Ethox's U.S. Patent Application Serial No. 13/067,571 ("the Ethox Application") evidences that PEM as a gas barrier additive to PET is known in the prior art (DTX 344; Tr. 951).

171. However, Ethox has until October 9, 2015, to take further action, including filing a Request for Continued Examination, appealing to the Patent Trial and Appeal Board, and re-filing the application (DTX344 at -15468; Tr. 952, 999-1001).

172. Furthermore, no rejection in the Ethox Application issued for the same subject matter as is found in the claims of the '265 Patent (See DTX344).

CONCLUSION

Based upon the foregoing findings of fact and conclusions of law, the undersigned has determined that the plaintiffs have shown by clear and convincing evidence that Dr. Tanner is an inventor of the '265 Patent. The plaintiffs proved that Dr. Tanner conceived of PEM as a gas barrier additive for use in PET containers, as well as ways to make PEM, as part of a collaboration with the defendant. Dr. Tanner's conception is corroborated. While the defendant had the Formula II structure, which embraces billions of compounds, prior to Dr. Tanner, conception of the subgenus of gas barrier additives with terminal phenoxy groups as found in Claim 11 was not yet complete. Dr. Tanner exercised significant inventive faculty in arriving at PEM as a gas barrier additive. PEM is the only terminal phenoxy gas barrier additive structure found in the specification and one of but six specific structures falling within Formula II. Under well-established Federal Circuit precedent, Dr. Tanner's activities are sufficient to qualify him as an inventor on the '265 Patent.

Accordingly, it is hereby ordered that judgment shall be entered in favor of the plaintiffs on the correction of inventorship claim and, for these same reasons, on the

defendant's counterclaims. The court will separately publish a judgment entry and, pursuant to 35 U.S.C. § 256, will order the Director of the United States Patent and Trademark Office to issue a certificate of correction adding James Tanner as a named inventor on United States Patent No. 8,110,265.

IT IS SO ORDERED.

s/Kevin F. McDonald
United States Magistrate Judge

September 30, 2015
Greenville, South Carolina